Learning Enhancement Team

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Steps into Numeracy

Multiplying & Dividing Fractions

This guide introduces multiplication and division of fractions and gives examples of how to carry out these essential skills.

Introduction

Multiplying and dividing fractions involve very similar methods. To become confident performing these fundamental mathematical skills you will need to be comfortable with the words used to describe fractions (see study guide: *Types of Fractions*) and be good at the skill of cancelling down a fraction (see study guide: *Cancelling Down Fractions*).

Multiplying fractions

Multiplying fractions is quite a straightforward skill to learn and master, in fact it is easier than adding and/or subtracting them. The method is to multiply all the numerators of the fractions in question together to give the numerator of the answer and to multiply all the denominators of the fractions in question together to find the denominator of the answer.

Example:　　Calculate $\dfrac{1}{2} \times \dfrac{3}{4}$.

To find the numerator of the answer you must multiply the numerators in the question (1 and 3 respectively). To find the denominator of the answer you must multiply the denominators in the question (2 and 4 respectively). You may find it beneficial to write the mathematics as follows:

$$\frac{1}{2} \times \frac{3}{4} = \frac{1 \times 3}{2 \times 4} = \frac{3}{8}$$

with a step which expresses the fractions with a single dividing line. This middle step may not seem necessary here as the multiplications are straightforward. However, in more complicated questions, the middle step is useful for cancelling down and simplifying the problem. If you find multiplying numbers together difficult you should read the study guides: *Multiplying Small Numbers* and *Multiplying Numbers*.

Sometimes the multiplications involved can be made easier by cancelling down the fractions first. This not only yields smaller numbers to multiply together (which is easier) but also produces the answer to the problem in its simplest form. Remember:

> **When multiplying any fractions always ask yourself at every step 'Can I cancel down?'.**

Example: Calculate $\dfrac{3}{5} \times \dfrac{5}{12}$.

This example is a little more complicated, mainly because the numbers are larger, but as you will see, cancelling down will simplify the problem. Writing the fractions with a single dividing line can help you to see that the 5's can be cancelled down. Often cancellations of this kind can be disguised by the fact that the number to be cancelled down appears in the numerator of one fraction and the denominator of another. By rewriting the fractions with a single dividing line you can see that, in this case, the 5's can be cancelled down:

$$\frac{3}{5} \times \frac{5}{12} = \frac{3 \times \cancel{5}}{\cancel{5} \times 12}$$

After cancelling down the 5's you are left with $\frac{3}{12}$:

$$\frac{3}{5} \times \frac{5}{12} = \frac{3 \times \cancel{5}}{\cancel{5} \times 12} = \frac{3}{12}$$

which can be simplified further. The denominator can be factorised as $12 = 3 \times 4$, so:

$$\frac{3}{5} \times \frac{5}{12} = \frac{3 \times \cancel{5}}{\cancel{5} \times 12} = \frac{3}{12} = \frac{3}{3 \times 4}$$

You can now cancel down the 3's to give the answer of $\frac{1}{4}$:

$$\frac{3}{5} \times \frac{5}{12} = \frac{3 \times \cancel{5}}{\cancel{5} \times 12} = \frac{3}{12} = \frac{\cancel{3}}{\cancel{3} \times 4} = \frac{1}{4}$$

You may notice that, even though the original question was about multiplying together two fractions, getting the answer required no multiplication at all!

> **To Multiply Fractions:**
>
> 1) **Multiply the numerators and denominators.**
>
> 2) **Cancel down when you can.**

Example: Multiplying improper fractions. Calculate $5 \times \dfrac{4}{7}$?

Here, you need to recognise that this is another question about multiplying fractions. The 5 can be re-expressed as an improper fraction as:

$$5 = \frac{5}{1}$$

By doing this you should be able to see that this *is* a question about multiplying fractions:

$$5 \times \frac{4}{7} = \frac{5}{1} \times \frac{4}{7} = \frac{5 \times 4}{1 \times 7} = \frac{20}{7}$$

(A common mistake in these kinds of questions is to multiply the numerator *and* denominator by the whole number. In this case the whole number is 5, which would give $\frac{20}{35}$, the wrong answer.)

Dividing fractions: the reciprocal

As you will see, dividing fractions is closely related to multiplying fractions. Firstly you should know how to take the **reciprocal** of a number as this also plays a crucial part in the division of fractions. To take the reciprocal of a number you first express it as a fraction (if it is not a fraction already) and then turn that fraction upside down so the numerator becomes the denominator and the denominator becomes the numerator.

Example: What is the reciprocal of 2?

As 2 can be written as an improper fraction as $\frac{2}{1}$, the reciprocal of 2 is obtained by turning $\frac{2}{1}$ upside down to give $\frac{1}{2}$. (You should also see that the reciprocal of $\frac{1}{2}$ is 2.)

When you are dividing two fractions, taking the reciprocal of the second fraction not only turns that fraction upside down but also changes the division into multiplication. You may remember this from school:

> **To Divide Fractions:**
>
> 1) **Take the reciprocal of the second fraction.**
>
> 2) **Multiply the resulting fractions together.**

Example: Calculate $\dfrac{1}{2} \div \dfrac{3}{4}$

Here $\frac{3}{4}$ is the second fraction and so you must take its reciprocal and then multiply

instead of divide. So, after performing the reciprocal and cancelling down:

$$\frac{1}{2} \div \frac{3}{4} = \frac{1}{2} \times \frac{4}{3} = \frac{1 \times 4}{2 \times 3} = \frac{2 \times \cancel{2}}{\cancel{2} \times 3} = \frac{2}{3}$$

Calculations commonly have a fraction above *and* below the dividing line. As a dividing line represents division, you should think of the problem as the upper fraction *divided by* the lower fraction. By writing the problem in this way you can use the method for dividing fractions detailed above.

Example: What is $\dfrac{\frac{3}{5}}{\frac{1}{7}}$?

The question can be thought of as $\frac{3}{5}$ divided by $\frac{1}{7}$ which can be written as $\frac{3}{5} \div \frac{1}{7}$. So, using the method outlined above, taking the reciprocal of the second fraction and multiplying the fractions together instead of dividing them gives:

$$\frac{3}{5} \div \frac{1}{7} = \frac{3}{5} \times \frac{7}{1} = \frac{21}{5}$$

Want to know more?

If you have any further questions about this topic you can make an appointment to see a **Learning Enhancement Tutor** in the **Student Support Service**, as well as speaking to your lecturer or adviser.

☽	Call:	01603 592761
▣	Ask:	ask.let@uea.ac.uk
☝	Click:	https://portal.uea.ac.uk/student-support-service/learning-enhancement

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